feather loss fail to account for plumages, it will be time enough to adopt theories demanding new life in epidermal structures, that for many months have been histologically dead. The existence of such a thing as 'aptosochromatism' will hardly be proved by those who have no grasp upon fundamental principles, and as long as such observers expect to be taken seriously, they must not be surprised if they are called sharply to account.

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INDIAN PICTOGRAPHS ON THE DAKOTA SANDSTONE.

The Dakota cretaceous formation which extends from northeastern Nebraska to southwestern Kansas is composed of massive ledges of sandstone alternating with beds of shale and clay. These ledges weather out and in many places form precipitous walls from ten to fifty feet high.

It is upon these walls that the Indians have written their history in pictographs. Traces of the drawings may be seen on dozens of cliffs in the two states. Old hunters and cattlemen tell us that twenty years ago or more the chalk cliffs of the Niobrara cretaceous in western Kansas were also covered with these inscriptions. But they have already disappeared because of the soft material composing the wall upon which they were carved. The Dakota sandstone being somewhat harder is consequently not so easily worn away and many of the drawings are still legible.

Not infrequently the sandstone wall in the immediate vicinity of one of the springs which abound in the Dakota will be covered with these hieroglyphics. This is the case at the Santee caves on the Platte river opposite Ashland, Nebraska, and at the noted cave section in Ellsworth county, Kansas. Again some prominent cliff or land-mark has evidently been selected. Pawnee rock on the old Santa Fé trail, the spot forever wedded to a tale of terror, was formerly covered with pictographs. The face of the rock has since been blasted away for building stone. A cliff of yellow sandstone standing boldly out on the north bank of the Smoky Hill river near the mouth of Alum creek contains some of the finest pictographs in the region.

In 1867 Dr. F. V. Hayden, United States Geologist described some pictographs near the Blackbird mission on the Missouri river some twenty miles south of Sioux City, Ia., as follows:

"About two miles above the mission the hills are cut by the river so as to reveal vertical bluffs, the rocks of which in the distance have a yellowish-white appearance and from this fact are usually called chalk bluffs. * * * This is perhaps the finest and largest exposure of the rocks of this group along the river. The mural exposures of soft sandstone present good surfaces for the Indian to make use of on which to write his rude history. And on the chalk bluffs there are many of these hieroglyphics in positions totally inaccessible to the Indian of the present time. None of them now living know anything about them and it is supposed that they must be very ancient, and that, since they were made, great changes must have been made in these bluffs by the waters of the Missouri. These markings are at least fifty feet above the water and fifty feet or more below the summit of the bluff, so that they must have been made before the lower portion of the bluff was washed away by the Missouri. It seems strange that none of these hieroglyphic writings which occur quite often on the chalk-rocks of the Niobrara group higher up the Missouri are known to any Indians now living. The creek near by is called in Dakota language the creek where the dead have worked on accounts of the markings on the rocks."

The pictographs referred to by Dr. Hayden may still be seen, although many of them are now practically obliterated.

Not infrequently these inscriptions occur in obscure cañons or lonely cliffs. The sandstone was easily scratched and the artist was evidently not seeking notoriety. Examples may be cited in a cañon five miles east of Kanapolis and in Cameron's draw near Belvidere, Kansas.

The writer has neither the ability nor inclination to discuss these picture writings from an ethnological standpoint. Doubtless the figures had a meaning, not only to those who drew them, but also to their contemporaries. Such writings are found in many, perhaps all parts

of the country. Human figures, horses, weapons, birds and symbols are the most common forms represented. In one place a man is seen leading seven ponies. Again the gigantic figure of a man about fifteen feet in length is reclining. Spears, shields, eagles, turtles, men on foot and horseback are scattered over the surface of the rocks in apparently endless confusion.

The soft sandstone is rapidly weathering away. In many places only mere outlines of the figures remain. Often the entire face of the cliff will fall off. It is but a question of a few years when the last trace of the figures will be gone. But more destructive than the ravages of time is the vandalism of man. It would seem that every white man who has visited these localities has felt it incumbent upon him to scratch his own name on the rock. This of itself might be considered only an exhibition of poor taste, were it not for the fact that he has almost invariably chosen to carve his own plebeian name over a pictograph. And with characteristic American thoroughness the scrawling letters are so broad and deep that the older figure is usually obliterated. Thus it is that many of the best examples of Indian picture writing have been and are being destroyed. Unfortunately there seems to be no way to prevent this vandalism. In a few years these records of a forgotten people shall have disappeared.

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February 10, 1900.

SYSTEMATIC ARRANGEMENT OF ORE DEPOSITS ON A GEOLOGICAL BASIS.

THERE has been, of late years, a growing tendency to consider ore deposits from a geological standpoint. Heretofore it has been the general custom to almost ignore the physical character and structure of the rock formations with which given ore bodies are associated.

As some sort of comparison must be necessarily made between ore bodies as they are developed, their classification crude though it is, begins to take place early in their consideration. With the ordinary miner such a scheme is strictly empirical, according to some obvious features presented. From this to a scientific plan the step is a long one.

Why the classification of ore bodies has remained so long in an unsatisfactory state, and little or no real progress made, while other related branches of knowledge have advanced with gigantic strides, finds its chief explanation in the fact that our methods of investigating the phenomena connected with the alteration of rocks generally were inadequate. Until the beginning of the last quarter of our century these methods were advanced but little beyond what they were a hundred years before. The activity in natural science studies was in other directions.

With the application of the microscope to the rocks and the opening of a new world to the geologist as vast and as interesting as that which the same magnifying glass gave to the biologist, rock metamorphism assumed a new rôle. Ore formation is found to be merely a special phase of general rock alteration. It goes on under the same conditions and by the workings of the same geological processes.

The study of ore genesis and relationships of ore bodies has become a strictly geological proposition. The recent investigation of the ores from the standpoint of geology appears to be capable of producing good results. It is replete with suggestive inference. With modern geology as a foundation the near future cannot but open up to us unheard of and unthought of advantages in the practical development of the ores. We stand on the threshold of a new era.

On this topic we get a glimpse of the general trend of modern thought respecting the genesis of ore deposits by reference to the principles, formulated by Prof. C. R. Van Hise in his treatise on the general metamorphism of rocks (not yet published), as adapted recently to ore deposits. This summary is contained in his paper on 'Some Principles controlling the Deposition of Ores,' read at the Washington meeting of the American Institute of Mining Engineers.

So far as the classification of ore deposits is concerned we appear safe in concluding that:

(1) The chief feature wherein the classificatory scheme hereafter presented differs from others, is in the prominence given to geological occurrence and the direct operation of the geological processes as essential factors in the genesis of the ore bodies.